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ABSTRACT

The paper reviews studies on performance objectives, task analysis, and prompting and instruction sequences as they relate to the education of handicapped students. The initial section, on performance objectives, reviews the development of the Vocational Behavior Checklist and the Subsequent Independent Living Behavior Checklist. The next step in the overall model, task analysis, is considered in terms of choosing task specificity. Instructional research is summarized according to sequence (backward chaining, forward chaining, whole task), mode of prompts (verbal, visual, physical, olfactory, gustatory), placement of prompts (pre-response and error correction), and quality of prompts (stimulus prompts and response prompts). The three aspects are integrated, and implications are drawn for teaching independence skills to handicapped populations. Among the implications are that specific performance objectives facilitate teaching and learning; that task analysis with more steps may be more helpful than task analysis with fewer steps; and that trainers could more efficiently train complex skills through the use of systematic procedures. References and six figures are appended. (CL)

Common Threads in Behavior Checklists, Task Analysis, Prompting, Operations Training, and Chaining Research

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Note of Appreciation

My students and I express our appreciation to the West Virginia Rehabilitation Research and Training Center, our funding agency, and the many rehabilitation workshops and individuals that contributed to this research series. The research was supported, in part, by the National Institute of Handicapped Research through the WV Rehabilitation Research and Training Center (West Virginia University and West Virginia Division of Vocational Rehabilitation).

The general teaching model that most people use currently is shown in Figure 1. We have always been more interested in the stimulus end of this paradigm than the consequence end. While some would argue that you can't separate discriminative stimuli and consequences, we have nevertheless pursued the investigation of stimulus conditions in learning. In the past 10 years, my graduate students and I have done some work in performance objectives, some work in task analysis, and some work in prompting and instruction sequences. We'll take a look at these topics separately first and at the end in a more integrated way.

Performance Objectives

In 1977 we reviewed 166 behavior checklists (Walls, Werner, Bacon, & Zane, 1977). We were interested in what kind of objectives people were using when working with mentally retarded and other individuals. So, we began collecting behavior checklists.

Informants consistently furnished the names of a few widely circulated instruments but almost invariably added one or more that was unknown to us. In an attempt to obtain useful documents and determine the scope of checklisting, an ad was placed in the APA Monitor, Educational Researcher, Psychology Today, and Behavior Research and Therapy. We did not state our definition of "behavior checklist" in the ad, but reviewed all "checklists" sent and evaluated them according to the criteria described below. The ad requested, "...behavior checklists used in tabulating behaviors or skills of the mentally retarded, children, psychiatric, or other populations." In

addition a form letter with the same request was sent to 823 state schools and facilities, child or adult psychiatric hospitals, narcotic or alcoholism hospitals, child or adult rehabilitation facilities, and mental retardation facilities. The return was an amazing assortment of variously inclusive or exclusive instruments. The list devisers had fashioned a remarkable variety of behavior item formats with similarly diversified scoring requirements.

We listed the title, source, behavior classes, method of scoring (e.g., direct observation), whether reliability and/or validity information was provided, a sample of the most objective item we could find in the checklist, and an example of the least objective item. For example, an objective item might be "jumps from height of 12 inches, landing on toes only." An example of a least objective item would be something like, "seems to feel persecuted." Even though most human service personnel would never write such poor objectives nowadays, we encountered quite a good number (probably more than the good items) 10 years ago. Here are some items that made us laugh when we read them.

* Blows on others faces
* Lies on floor with feet up in air
* Unwraps candy before eating it
* Burps at others
* Is not afraid of toothbrush
* Refuses to use can opener
* Is girl crazy

* Has peculiar ideas

* Rolls consecutively as a means of traveling

* Sits by anything that vibrates

Each of the 166 checklists was classified in terms of the objectivity with which the items were written. Category 5 meant that the checklist items were clearly specified in terms of conditions of performance, observable behaviors, and standards of performance. Checklists ranged all the way down to category 1 in which items were so vague and general that measurement would have been difficult or impossible.

We had set out to avoid the need for writing our own behavior checklist. We reasoned that there were bound to be good ones out there that would suit our purposes. But alas, we ended up taking the vocational behaviors that we could find in the 166 checklists that we reviewed and rewriting each objective in terms of condition, behavior, and standard. We filled some obvious holes and ended up with 344 skill objectives in the Vocational Behavior Checklist (Walls, Zane, & Werner, 1978) covering the areas of prevocational skills, job seeking skills, interview skills, job related skills, work performance skills, on-the-job social skills, and union/financial/security skills. For example, a skill objective from the interview section is presented in Figure 2. Since 1978, over 10,000 copies of the VBC have been distributed here and abroad. People are using it in a wide variety of ways to define their prevocational and work adjustment programs, evaluate client skills at entry, track progress through a training program, and evaluate gains in the rehabilitation process. We

consider this to be remarkable and very reinforcing considering that the skill objectives are simply that - - they are descriptive rather than prescriptive. They are simply cleanly written, highly specific performance objectives, each having a condition, behavior, and standard.

Buoyed by the apparent early success of the VBC, we decided that there was also a need for a checklist of specific skill objectives for independent living. The Independent Living Behavior Checklist (Walls, Zane, & Thvedt, 1979) was constructed in the same manner, drawing on the earlier review of the 166 behavior checklists. The ILBC consists of 343 skill objectives in the areas of mobility skills, self-care skills, home maintenance and safety skills, food skills, social and communication skills, and functional academic skills. This checklist has also been moderately popular, and over 7000 copies have been distributed.

Task Analysis

The next step in the overall model, after performance objectives, is task analysis. The conventional wisdom in the literature has been to make the size of the steps in a task analysis suit the learner. Whereas, this sounds pretty good, it actually provides relatively little guidance. When you start to write a task analysis and list the steps, these steps can be as fine-grained as minute movements or as coarse as you please. We went back in the literature to the earliest industrial time and motion studies ala Gilbreth and Gilbreth (1918) (THERBLIG) and still found the problem of choosing a degree of

specificity for the description of human tasks to be a puzzling one.

In our task analysis study (Crist, Walls, & Haught, 1984), as in many other of our experimental studies, mechanical apparatuses were used as the tasks. A Briggs and Stratton lawn mower engine, a Black and Decker electric drill, and Ford carburetor were the apparatuses used in this study. A working Briggs and Stratton lawn mower engine probably has more than 100 parts, but we made apparatuses that each had 14 parts by using only the basic gears, shafts, and so on. The subjects were employees at the Northwestern Workshop in Winchester, VA In this study, as in subsequent studies I'll describe, subjects had been classified as being at least mildly mentally retarded. Each subject learned one of the apparatuses by the short task analysis, one of the apparatuses by the medium task analysis, and one of the apparatuses by the long task analysis. Although each apparatus had 14 parts to assemble, the long task analysis consisted of 28 steps (correct selection and correct placement of each part), the medium task analysis had 14 steps (selection and placement of each part taught as one step), and the short task analysis had 7 steps (selection and placement of 2 consecutive parts taught as a single step).

We found (Figure 3) that for subjects who were classified as mildly or moderately mentally retarded, the long and medium task analyses were equally good, but the short task analysis produced more errors. For severely mentally retarded subjects, however, the long task analysis was better than the medium task analysis which was, in turn, better than the short task analysis. What this tells us is, at

least with these types of tasks, the more help the better. This seemed to be true with all subjects, but was especially helpful to the most handicapped learners.

Instruction

You can picture instruction as we showed it in a book in which we tried to summarize principles of planning, teaching, and evaluating learning (Walls, Haught, & Dowler, 1982). There are sequences (backward chaining, forward chaining, whole task), modes of prompts (verbal, visual, physical, olfactory, gustatory), placement of prompts (preresponse and error correction), and quality of prompts (stimulus prompts and response prompts).

One of the things we wanted to do was to find out how trainers who work with handicapped learners teach (Walls, Zane, & Thvedt, 1980). What sequence do they use? What mode of prompts do they use? Do they use more preresponse or error correction prompting? Do they use a structured method of teaching or make decision rules as they go along? And, does it make any difference?

We contacted the Baltimore Association for Retarded Citizens and went to summer camp with them at Camp Adventure in the Maryland mountains. We used our standard arsenal of mechanical apparatuses. The trainers were the subjects in this experiment. They were trainers who worked with clients everyday, they all came from different educational backgrounds, and there had been no standard in-service method of teaching advocated by the ARC. We made sure that the trainers knew the tasks thoroughly before they taught, but we avoided

teaching them and just had them disassemble and reassemble the apparatus until they were proficient.

A modified multiple baseline design was used in which the trainer taught 1, 2, or 3 of the 4 tasks by his or her own method and then taught the remaining task(s) by a method we assigned. When they taught by their own method, they were instructed, "You can teach it any way you want to. We want you to use your own way of teaching. Any way you like or any way that you usually use is OK."

After teaching by their own method, 3 of the 6 trainers then taught by the structured whole task method and the other 3 taught by backward chaining. These structured approaches involved visual, verbal, and physical prompts and both preresponse and error correction timing in a prescribed way. This was done so that we could determine not only the characteristics of their own approach, but also compare it with a standard definable sequence and prompting method. When teaching by their own methods, 3 trainers used a whole method, 2 used a comination of whole and chaining, and 1 used a forward chaining procedure.

Trainers naturally used a fairly large number of visual preresponse prompts, but one of the notable findings was that whether using preresponse or error correction they used a great many verbal prompts. They seemed to want to talk their clients to death. And when teaching by their own methods, they used virtually no physical prompts. Their teaching procedures were, overall, highly idiosyncratic and very unsystematic. One trainer, after 2 frustrating days, said something to the effect, "Boy, this is terrible, What was

it I learned in school about backward chaining." He was then pleased, as were we, that his client learned quickly when he spontaneously switched to pure backward chaining.

As you might guess, when trainers were forced to switch to one of the two highly structured methods of teaching, training time and error rates decreased. We also recorded the praise and reprimands used by these trainers, but prompts and stimulus sequences were much more highly associated with learner performance than were consequences.

In this study, we had lumped together different types of prompts, so we decided to try for some clearer component analyses. In one study we compared forward chaining, backward chaining, and whole task sequences (Walls, Zane, & Ellis, 1981). The subjects were workshop clients at the Vocational Rehabilitation Center in Pittsburgh. A counter balanced design was used in which subjects were taught to assemble a carburetor, a bicycle brake, and a meat grinder. Physical correction was the primary prompt and training trials were alternated with test or probe trials. As expected, both chaining procedures yielded a much lower percentage of errors than the whole task method. Time, however, did not differ.

Another experiment to try to separate training effects dealt with visual, verbal, physical prompting, and a combination of these (Walls, Ellis, Zane, & Vanderpoel, 1979). Clients from the Philadelphia Association for Retarded Citizens Developmental Center learned to assemble a movie projector, carburetor, bicycle brake, and lawn mower engine. A whole task method with error correction prompting was used. The dependent variables were total number of errors, placement errors,

order of selection errors, total time, time per trial, and errors in relearning the task two weeks later. Three of the four prompting conditions did not differ significantly on any of these dependent measures. As you would no doubt guess, verbal prompting alone was terrible, but physical, visual, and combination prompts were equally effective.

The question sometimes surfaces about whether a least-to-most restrictive sequence of prompts or a most-to-least restrictive sequence should be used. In other words, when a person needs help, (after an error), is it better to give the strongest prompt available (physical guidance) or a weaker prompt (verbal instruction) in hopes that it will be a sufficient correction cue (Walls, Crist, Sienicki, & Grant, 1981). In this study (at the Marion County Opportunity Workshop, Fairmont, WV) involving shirt folding, table setting, and tape recorder use, each with 9 steps in the task analysis, we contrasted a least-to-most restrictive with a most-to-least restrictive prompting sequence. The most-to-least restrictive sequence went from physical guidance to a visual modeling prompt to a verbal instruction prompt. The least-to-most restrictive sequence was the opposite of this, and a third condition used only graduated guidance in a physical prompting mode. Although these sequences are often spoken of, they were difficult to operationalize in this study. Perhaps we should have done it another way, but the results showed no difference among these treatments.

Another issue that we examined was the placement and timing of prompts. In one study we taught clients from the District of Columbia

ARC to assemble a carburetor, bicycle brake, lawn mower engine, and dishwasher pump. Preresponse prompting was better than error correction in terms of time and errors (Zane, Walls, & Thvedt, 1981). This was true for both a backward chaining and a whole task sequence. For a second study on placement of prompts, one of my students convinced me that preresponse and error correction prompting should interact with the length of the task (Haught, Walls, & Crist, 1984). She reasoned that error correction prompts functioned more like stimulus prompts in which the learner is forced to consider relationships among the parts of the discriminative stimulus. In contrast, preresponse prompts that require only a copying or model matching response function more like response prompts which simply get the correct response from the learner and require little consideration of the stimuli. She further proposed that error correction prompts should be more useful in longer, complex tasks than in short ones. We used 6 and 12 part assemblies of the bicycle brake, lawn mower engine, carburetor, and electric drill with clients at the Harrison County Workshop, Clarksburg, WV. Error correction prompting did prove better on test probe trials, but there was no interaction with short or long tasks. We also obtained ambiguous findings in a study examining transfer from tasks taught by either preresponse prompting or error correction prompting to tasks taught by error correction prompting (Ellis, Walls, & Zane, 1980).

Another way of controlling the placement of prompts is through timing. In two studies we operationalized Touchette's progressive delay paradigm for training tasks with more than one response. In the

first study, (Walls, Haught, & Dowler, 1982) clients from the Taylor County Workshop, Grafton, WV were taught to assemble the lawn mower engine, electric drill, and bicycle brake. We compared a 1 second, 3 second, and 5 second progressive delay of prompts. The trainers counted 1 second beats of a Seth-Thomas metronome to time the prompts. In other words, in the 3 second delay condition, 3 seconds were added to the time that the subject had to respond before the prompt was given. When a learner made the right response to a particular part, either before or after a prompt, 3 more seconds were added to the prompt delay for that part. The 1 second delay condition produced fewest errors, most trials with no errors, and earliest acquisition of the task. In another study (Walls, Dowler, Haught, & Zawlocki, 1984), clients at the WV Rehabilitation Center Workshop were taught to assemble 4 apparatuses. We wanted to see how the 1 second progressive delay (the best condition in the other study) would work with whole task versus forward chaining. Figure 5 shows the result. We had reasoned that progressive delay coupled with a progressive sequence such as forward chaining should produce the best results. As you can see from Figure 1, it did, but forward chaining also proved to be powerful in keeping error rates low.

Another legendary effect in the literature is the learner's history, experience with, or preference for a particular stimulus. Since word has it that we should also prompt and fade on the same dimension as that of the task itself, we sought to examine the effects of preference, prompt, and task agreement on discrimination learning (Dowler, Walls, Haught, & Zawlocki, 1984). We couldn't figure out how

to use apparatuses, so we used wires, hardware, moldings, capacitors, and fasteners as shown in Figure 6. Preference as measured by our screening task did not seem to increase the effectiveness of the prompts. The study did show, though, that prompting in the same dimension as the task was effective in terms of errors, training time, and number of training trials.

Several other papers have considered what the stimulus in chaining really is (Thvedt, Zane, & Walls, 1984), how fading of the prompt should be done (Ellis, Ludlow, & Walls, 1978), and whether it is better to fade on the S+, the S-, both or neither (Zawlocki & Walls, 1983).

Does any of this make any difference? Can you really teach people skills that have some value for adaptive functioning in our society? You can, indeed. We taught workshop clients basic operations like using a rachet and socket, testing wires for continuity with an ohm meter, tightening screws with the appropriate screwdriver, measuring angles with a bevel square, using a carpenter's level, and sawing with a miter box (Walls, Sienicki, & Crist, 1981). Clients who had learned these basic operations were much better at trouble shooting, repairing, and constructing than clients without these basic operations in their repertorie. When you look at the wide variety of operations and tools involved in sheltered or competitive employment, the mastery of basic operations looms large in the scope of planning and teaching for independence (Walls, Haught, & Crist, 1982). The amount of money we spend to rehabilitate a client to productive employment is paltry compared to the human and economic

gains that are realized (Walls, Tseng, & Zarin, 1976).

Research has amply demonstrated that specific performance objectives facilitate teaching and learning. While the truism is that the steps in the task analysis should be suited to the learner, it appears that when in doubt, you should go for a task analysis that has more steps rather than fewer. With regard to instruction, trainers do not appear to spontaneously use systematic approaches. Although they care about their learners and usually get the job done, they would be more efficient and be able to train more complex skills through the use of systematic procedures. Short tasks can usually be trained very well by the whole task method, but a chaining approach can reduce errors in the training of almost any task. Error correction prompting certainly produces more errors, but may be beneficial if you want more than mechanical responding. Active consideration of relations among stimuli should be facilitated when possible. The progressive delay of prompts aradigm is clumsy to use, but the prompting needs of the learner are constantly adjusting the balance between preresponse and error correction prompts. I view the future with optimism. I see both trainers and researchers becoming more sophisticated in understanding and addressing the needs of learners. This systematic approach to planning, teaching, and evaluating will both advance our knowledge and lead to greater independence for those we serve.

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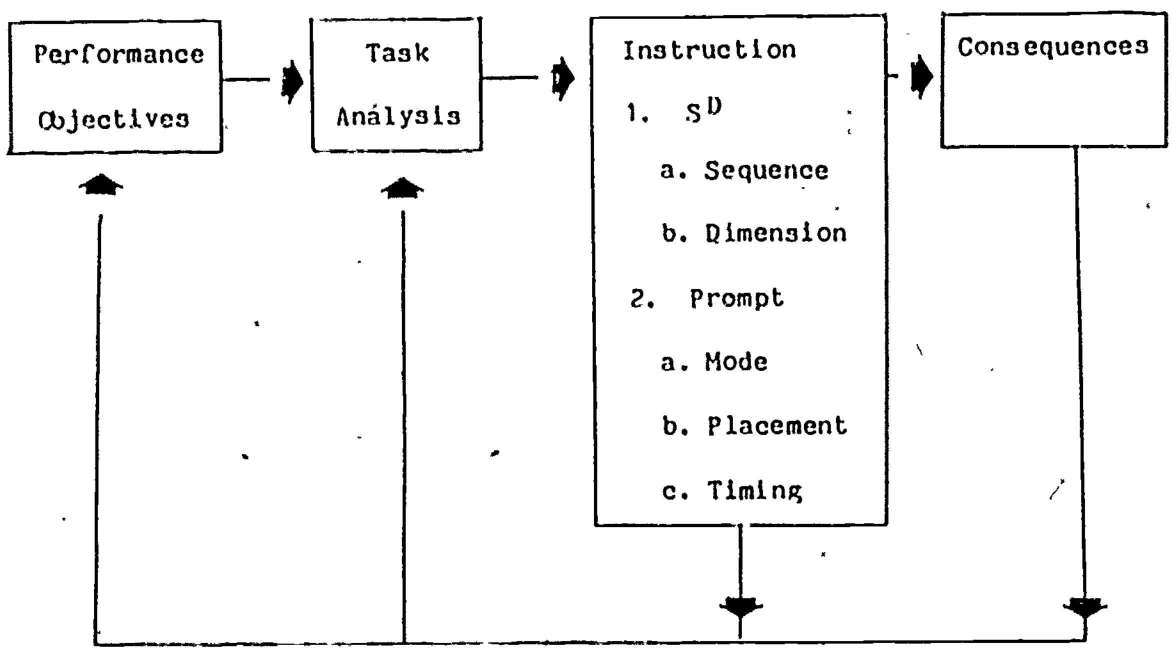

Figure 1. Model of systematic teaching.

INTERVIEWER INTERESTS 2

CONDITION:	Given only the verbal instruction.
INSTRUCTION:	Name the four things that the interviewer will probably ask you questions about."
BEHAVIOR:	Client will name. (1) previous work experience, (2) education, (3) current skills and (4) personal interest and goals.
STANDARD:	Behavior within two minutes on three of four occasions. Each of the four areas of questions must be named

Figure 2. Sample skill objective from the Vocational Behavior Checklist.

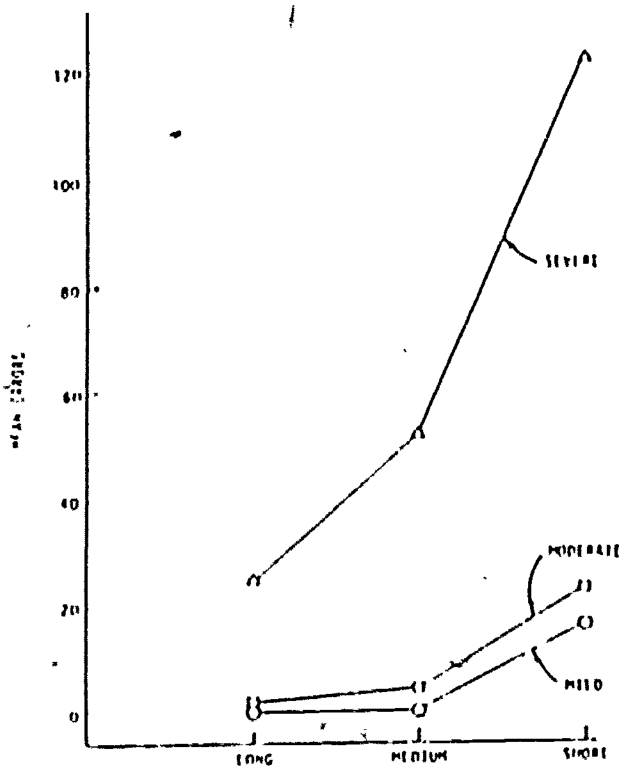

Figure 3. Mean errors in training trials.

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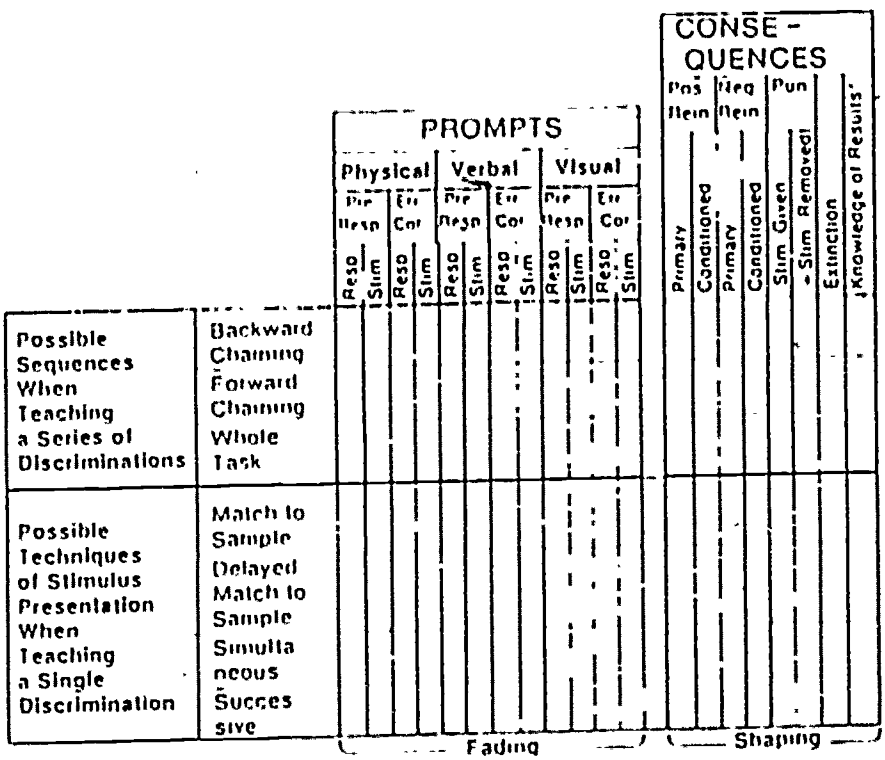

*Knowledge of Results of the response may also be provided by error correction prompts, reinforcement, punishment, and extinction

Figure 4. Instructional components and procedures.

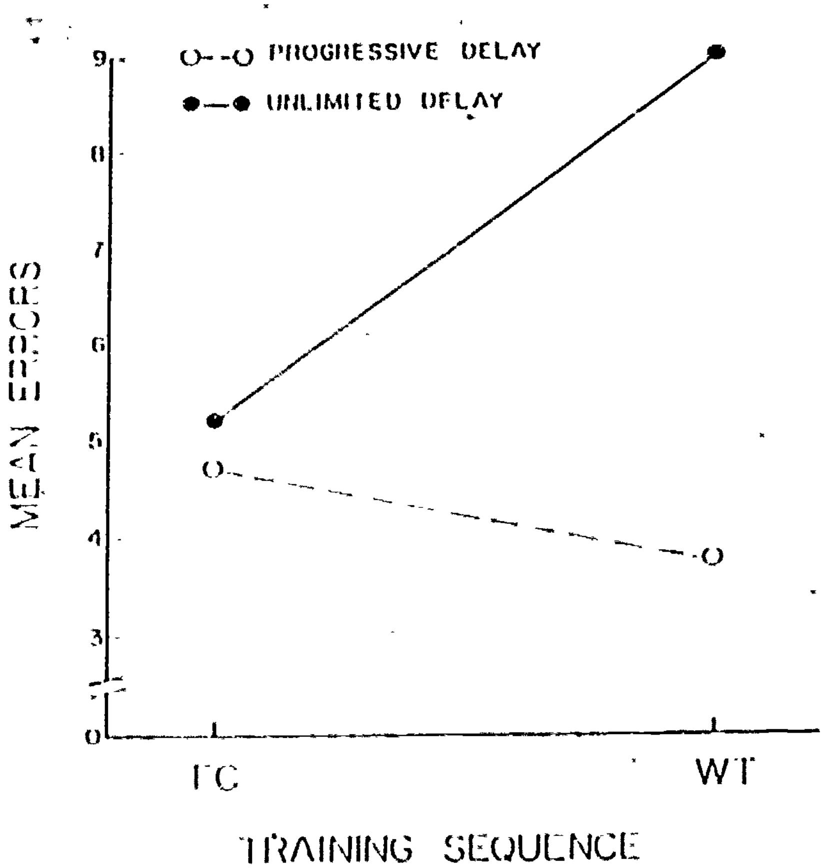

Figure 5. Mean errors for training sequence by delay conditions.

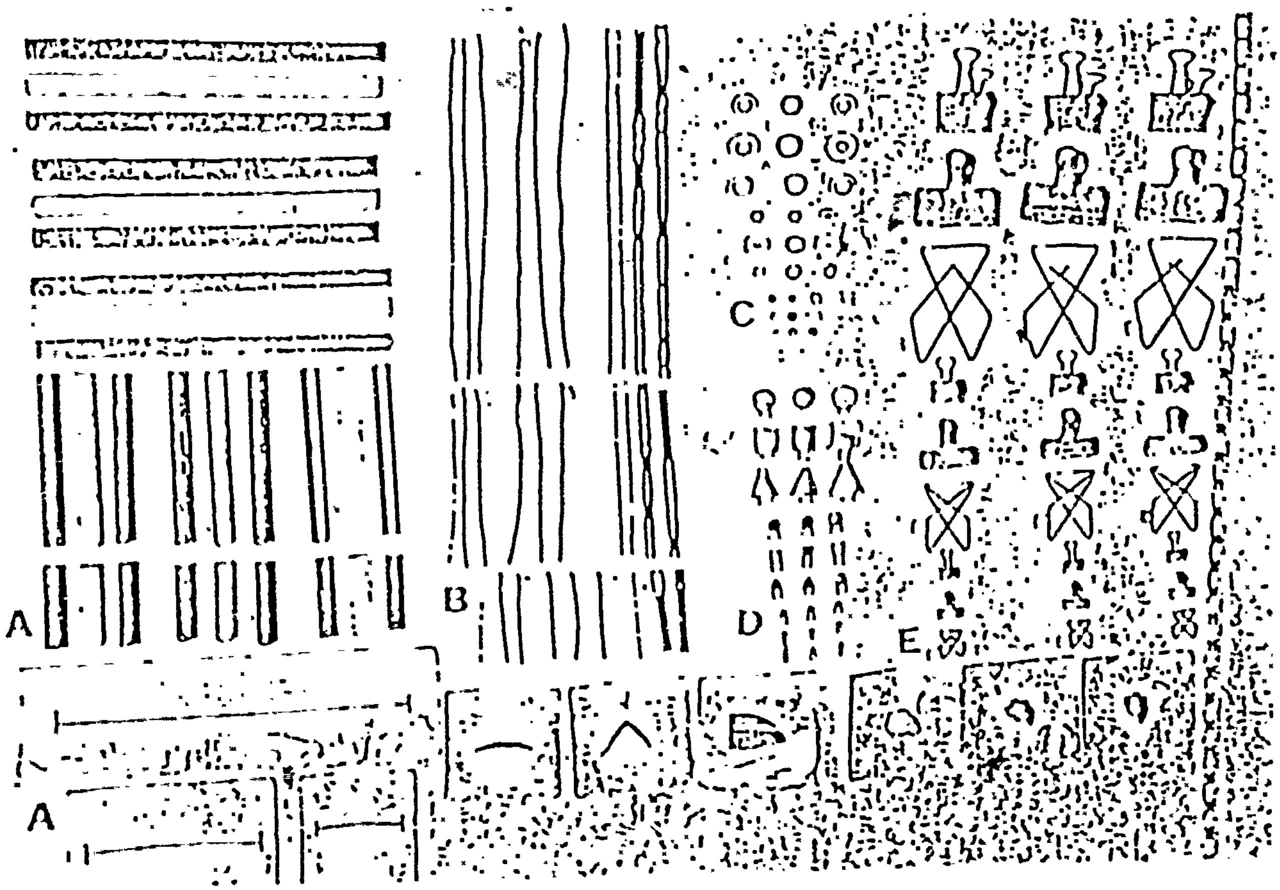

Figure 6. Stimulus materials (a) moldings, (b) wires, (c) hardware, (d) capasitors, (e) paper fasteners and the size, color, and shape prompts that accompanies task A (moldings).

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